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PALEONTOLOGICAL NOTES.

IV.* VIEW OF THE CARBONIFEROUS FAUNA OF THE NARRAGANSETT BASIN.

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WHILE the flora of the Narragansett coal basin is abundant, remains of about eighty-eight species of plants having been detected in the black carbonaceous shales and lighter sandstones, but few traces of animal life have been found, these being mostly the wings of cockroaches and other net-veined insects.

The age of these beds was originally supposed by the elder Hitchcock to be Lower Carboniferous, but from a collection from the black shales near the western edge of the Narragansett coal basin, at Providence and Pawtucket, in the Museum of Brown University, sent by us for examination by Lesquereux, he referred the beds to the Upper Carboniferous, stating in a letter to us :

"These specimens, taken together, are interesting, as indicating more than any other lot I have seen of fossil plants of Rhode Island, the stratigraphical relations of your coal strata to those of the upper part of the anthracite measures of Pennsylvania, where, even, I have not observed such a predominance of species of *Odontopteris* typically allied to those described by Fontaine and White from the Upper Carboniferous of Pennsylvania." †

Besides the fourteen species of insects and an arachnid described by Scudder ‡ from the plant beds of Rhode Island, we have previously noticed § the discovery of other fossil animals, viz., *Spirorbis carbonarius*,

* Paleontological notes I.-III. appeared in Proceedings Boston Society of Natural History, xxiv., 1889, pp. 209-216. See also Recent discoveries in the Carboniferous flora and fauna of Rhode Island (Amer. Journ. Sci., 3d Series, xxxvii., p. 411, 1889).

† Proceedings Boston Soc. Nat. Hist., xxiv., 1889, p. 214.

‡ Insect fauna of the Rhode Island coal field. Bulletin U. S. Geol. Survey, No. 101, 1893.

§ *L. c.*, p. 214.

the supposed impression of an Annelid, and the track either of a mollusc or worm. We now have to announce the discovery of additional animal remains and tracks detected by Mr. J. H. Clarke of Providence, who for nearly thirty years has industriously collected in this coal field. These comprise casts of a fresh-water bivalve, *Anthracomya arenacea*, small footprints, possibly those of a shrimp-like animal (*Protichnites carbonarius*), and an impression which seems to be rather worm-like than plant-like.

We will enumerate these forms in a way to give a conspectus of the animal life of the Narragansett coal basin, so far as known up to the present time.

ANNELIDA.

Spirorbis carbonarius. Pawtucket plant beds. (Scholfield and Gorham) Proc. Bost. Soc. Nat. Hist., xxiv, 1889, p. 214.

Impression of an Annelid? Pawtucket plant bed. (Scholfield) Ibid., p. 215.

Impression of a plant or worm? This marking or impression was found by Mr. J. H. Clarke in a boulder of fine red shale at South Attleboro, Mass. Whether it is an impression of an aquatic plant or of a worm I am not sure, but am rather inclined to regard it as a worm-cast. It is serpentine, with from four to five curves, no two curves alike. In front it ends broadly, is pointed triangularly, tapering more at what appears to be the posterior end. Length 70 mm.; greatest breadth 4 mm.

Sections of worm holes. I am indebted to Mr. J. B. Woodworth for the opportunity of visiting with him an interesting quarry, one mile south of East Attleboro, in red and green shales and light conglomerates, the greenish shales showing distinct coarse ripple marks, rain-drops, and mud cracks, besides numerous sections of worm holes, perpendicular to the bedding. The worm holes are abundant, some eight or ten to the square inch, and varying in size from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in diameter. The round deep holes had been excavated in a fine mud, and then, after the worms had left them or died, silted up with fine sand. If the worms which made these deep holes were fresh-water forms they were much larger than any Nais-like Oligochetes known to us at the present day, and were possibly therefore marine.

MOLLUSCA.

Anthracomya arenacea (Dawson) Hind. (Fig. 1, A, B, C.) These occurred in a small boulder of fine black shale found by Mr. Clarke at

Valley Falls. In this specimen there were about a dozen casts of valves of old and partially grown shells with the shape and markings in some cases well preserved owing to the fineness of the shale. Another specimen showing well the shape of the valves was detected in the black shaly plant-beds enclosing a vein of coal just north of Silver Spring, East Providence, by Prof. F. P. Gorham, associated with the verticillate leaves apparently of *Calamites*. In these specimens the valves are elliptical, long, narrow, pod-like, the anterior end but little larger and rounder than the posterior end. The umbones are situated at or between the anterior $\frac{1}{3}$ and $\frac{1}{4}$ of the shell. There are about twenty-five fine lines of growth. The fully grown specimens are narrower than the young and the anterior is but little larger and rounder than the posterior end. Size and proportions of the largest examples: length 22 mm., breadth 9 mm., being about $2\frac{1}{2}$ times as long as wide. Length of the East Providence example, 17 mm.; breadth, 9 mm. In this example the umbones are situated near the anterior fourth of the valve. The young in the loose boulder were 10 mm. in length, 5 mm. in width, or one-half as wide as long, with numerous fine lines of growth.

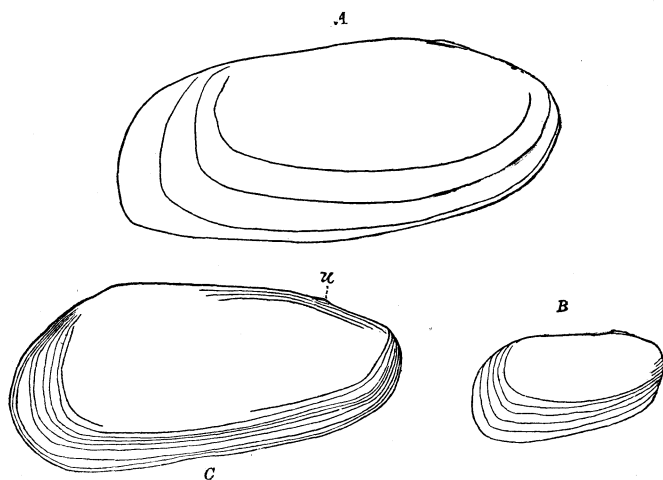


FIGURE 1. — *Anthracomya arenacea*. $\times 2\frac{2}{3}$. u, umbo.

The Rhode Island specimens present no differences from the description and figures of Dawson (*Acadian Geology*, 3d edit., p. 205). It is an entirely different species from *Naiadites elongatus* and *laevis* Dawson, of

which I have examples, kindly sent me by the late Sir J. W. Dawson. It is also different from any British species figured by Wheelton Hind in his elaborate monograph. Desirous of comparing our specimens with types from Nova Scotia, I applied to Dr. G. M. Dawson, Director of the Geological Survey of Canada, who very kindly sent me specimens from the museum of the Survey, labelled in Sir J. W. Dawson's own handwriting, from Sydney, C. B. I can see no specific differences, although the Sydney examples are casts in a rather coarse micaceous sandstone, a less favorable medium for the preservation of specific marks; but the general shape and proportions of the valves are the same. The Sydney examples are small specimens from 8 to 14 mm. in length; each end is much alike, and the beaks are plainly situated at the anterior $\frac{1}{4}$ – $\frac{1}{5}$ of the shell; in the largest one at the anterior third. In Fig. 1, *A* represents a large, and *B* a much smaller specimen in the pebble found by Mr. Clark, and *C* a specimen intermediate in size found in place by Prof. Gorham. All are drawn to the same scale and are enlarged.

Track of a gastropod mollusc? Pawtucket plant beds. (Scholfield) Proc. Bost. Soc. Nat. Hist., xxiv., p. 215. This track is, of course, doubtful, and might have been made by a worm.

MEROSTOMATA.

Protichnites narragansettensis, n. sp. This name is given to a new kind of track discovered in a pebble of dark arenaceous shale taken from a kame in north Providence by one of my class, Mr. H. H. Mason. It is allied to and evidently made by a species of perhaps the same group as made the tracks described as *Protichnites octonotatus* Owen, and *P. loganensis* Marsh from the Cambrian. Description and figures are reserved for a future occasion.

CRUSTACEA.

Remains of a Crustacean? Three fragments of the remains of what appears to be a macrurous crustacean were found in the black shales of Valley Falls by Mr. Clarke, associated with the leaves of Calamites. The better preserved fragment is square at the base, with one side produced above and ending squarely; the lower corners are truncated. On the lower edge of this fragment is a distinct raised boss or tubercle, while the two other fragments are not thus marked. The plates remind one of the epimerum of a shrimp, which is wider on the ventral edge than above. The surface is polished but has not the markings of a *Pandalus*. The surface is however marked with very fine irregular raised lines

passing across the surface. The edge is margined somewhat as in *Pandalus*.

I was at a loss to what group to refer these remains, but on showing them to Prof. C. E. Beecher he suggested that they might be crustacean, and I am inclined to agree with him. The sides of the segments of *Acanthotelson* are no wider ventrally than tergally ; there is also no close resemblance to the segments of *Palæocaris*, both being from the Carboniferous beds of Mazon Creek, Illinois. It is possible that they may belong to some true shrimp such as *Anthrapalæmon* or other macruran of that period.

Ostrakichnites carbonarius (*Protichnites carbonarius*) Dawson, *Acadian Geology* 3d edit., 1878, p. 55. Fig. 9, a.

Dawson describes and figures certain tracks from the millstone grit formation at McKay's Head in Nova Scotia which he refers to *Protichnites* and which he supposes to have been made by a *Limulus*-like animal.

Somewhat similar but much less regularly arranged tracks occurred in a boulder of fine red shale found in a stone wall at South Attleboro, kindly given me by Mr. J. H. Clarke. The tracks were associated with mud cracks, raindrops, and the worm-like impression already mentioned.

They are of the same size as those figured by Dawson, but are not so regularly arranged, being much more scattered, and with no median linear tail-mark. Yet the individual impressions are of the same shape and size, and so like those of Dawson's *Protichnites* that they were apparently made by the same kind of animal and could perhaps have been made by the extremities of the feet of a small shrimp-like creature.

The impressions are in sets of three, each of which is round in front, deep and succeeded behind by a shallow faint furrow, showing where the tip of the foot or spine of the hinder feet had trailed over the mud, before the final impress of the feet was made. The three impressions are not arranged in a straight line, but in a slightly curved line, showing that the middle spine or claw was longer than the lateral ones. In some cases there are single impressions forming two series about 8 mm. apart, but with no tail-mark between.

The *Protichnites* tracks figured by Dawson, could not have been made by a full grown *Euproöps* or *Prestwichia*, and it should be observed that the set of three prints is quite different from the long oblique crescentic tracks made by the hind cephalic legs of *Limulus*. The tracks might as well have been made by the crustaceans *Gampsonychus*, *Anthrapalæmon*,

or *Acanthotelson*, whose legs end in a sharp point. As the tracks were evidently not made by any merostome, we have thought it well to refer these trails to a new genus, for which we propose the name *Ostrakichnites*, although we are not fully persuaded that it is worth while to bestow names on these tracks, except for convenience of reference.

ARACHNIDA.

Anthracomartus woodruffi Scudd. Pawtucket plant beds. (Rev. E. F. Clark.)

INSECTA.

Myiacris packardii Scudd. Bristol plant beds. (Rev. E. F. Clark.)

Etolblattina illustris Scudd. Pawtucket plant beds. (J. H. Clark.)

" *sp.* Silver Spring, East Providence. (H. Scholfield.)

" *clarkii* Scudd. Pawtucket plant beds. (Rev. E. F. Clark.)

" *scholfieldii* Scudd. East Providence plant beds. (H. Scholfield.)

" *sp.* Fenner's Ledge, Cranston, near Providence. (F. P. Gorham and H. Scholfield.)

" *gorhami* Scudd. Pawtucket plant beds. (F. P. Gorham.)

" *exilis* Scudd. From a boulder near Kettle Point, East Providence. (H. Scholfield.)

" *sp.* Pawtucket plant beds. (H. Scholfield.)

" *reliqua.* Pawtucket plant beds. (F. P. Gorham.)

Gerablattina scapularis Scudd. Pawtucket plant beds. (H. Scholfield.)

" *fraterna* Scudd. Silver Spring, East Providence. (H. Scholfield.)

Rhaphidiopsis diversipenna Scudd. Cranston plant beds. (Rev. E. F. Clark.)

Paralogus æschnoides Scudd. Silver Spring, East Providence. (F. P. Gorham.)

The presence of the *Spirorbis* and of the tracks of two marine Arthropods suggest that the Rhode Island plant-beds, even if in general of fresh water origin, were deposited where the sea had access to them. The presence of these marine fossils, with the fresh water naiad, *Anthracomyia arenacea*, strongly suggests that the horizon of the black shales of Providence and also of the red and greenish beds of Attleboro, Mass., belong to the same horizon as those of the South Joggins of Nova Scotia, which is Upper Carboniferous, the rocks there consisting of sandstones and dark carbonaceous shales, frequently becoming reddish. The South Joggins shales also contain the remains of *Anthrapalæmon*, which should be looked for in the Narragansett coal measures. Thus far, then, the animal remains confirm Lesquereux's reference of the dark plant-beds to the Upper Coal Measures.

These beds also appear to be higher in the series than the Middle Carboniferous Mazon Creek beds of Illinois which contain a larger

number of marine animals, viz., Belinuridæ (Euproöps, Prestwichia and Belinurus), besides Anthrapalæmon and Acanthotelson, together with the impressions of marine annelid worms.

It should be observed that the black plant-beds of Providence on the western side of Providence Bay, which dip southeastward at an angle of 45° – 50° , extend over to the arkose conglomerates on the western edge of the basin, which are very highly inclined and dip westwards. The thickness of the plant-beds, unless much folded, appears to be over a mile. The exact relations of the plant-beds on the eastern side of Providence to the arkose conglomerates we have thus far been unable to definitely determine.*

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* Since reading this proof I have, at a point about half a mile north of Natick, on the western edge of the coal basin, seen the gradual passage of the carboniferous shales into the arkose.